

Predictive Value And Association Between Microalbuminuria And Prolonged Qtc Interval In Hypertensive And Type 2 Diabetes Mellitus Patients

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Abstract:

Background: Diabetes Mellitus and Hypertension are the diseases known to mankind since past 2000 years. Microalbuminuria is a well-known predictor of poor renal outcomes in patients with type 2 diabetes and in essential hypertension. Cardiac autonomic neuropathy (CAN) is a serious and common complication of diabetes and hypertension. Prolongation of the corrected QT interval (QTc) has been demonstrated to be a specific indicator of CAN in most studies. Microalbuminuria is currently considered as a strong predictor of premature cardiovascular death in these populations.

Objective: To find out the predictive value and association between microalbuminuria & prolonged QTc interval in patients of Type-2 Diabetes Mellitus and Hypertension.

Materials and Methods: The present study was conducted in Mahatma Gandhi Medical College and Hospital, Jaipur. A total of 100 patients of Type 2 DM and Hypertension were included in the study. After complete medical history and physical examination, routine biochemical analysis of blood and urine were obtained from every patient. Albumin excretion rate was determined by NycocardTM test. ECG was done to calculate QT interval. Corrected QT interval was calculated by Bazett's formula.

Results: Prevalence of microalbuminuria in our study was 60% in diabetic subjects (24 out of 40), 73.33% in hypertensive subjects (22 out of 30) and 93.3% in subjects having both DM+HTN (28 out of 30). Prevalence of QTc prolongation (CAN) in our study was 37.5% in diabetic subjects (15 out of 40), 46.7% in hypertensive subjects (14 out of 30) and 73.3% in subjects having both DM+ HTN (22 out of 30). Longer duration of diabetes and hypertension, and older age groups had increased risk of cardiac autonomic neuropathy. However patients having both entities together had early onset of cardiac autonomic neuropathy as compared to the patient having these entities separately. A prolonged QTc interval correlated positively with the presence of microalbuminuria; it was observed across all the three groups of the study. ($p < 0.05$).

Conclusion: We found that there was a high prevalence of Cardiac Autonomic Neuropathy (CAN) (as predicted by prolonged QTc interval in ECG) and Diabetic Nephropathy (as predicted by microalbuminuria) in patients with Type 2 DM and HTN. Their prevalence was significantly higher in diabetic hypertensives when compared with patients having any of the diseases singly. Also, the prevalence increased with increase in duration and severity of the disease. The complication occurs at lesser duration, with DM and HTN combined together. We also found positive association between microalbuminuria and prolonged QTc interval in all the three study groups. Thus, microalbuminuria signifies QTc prolongation in patients with DM and HTN. It indicates excess cardiovascular morbidity and mortality in these patients.

Keywords: CAN, Diabetes Mellitus, Hypertension, Microalbuminuria

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I. Introduction

Diabetes is expanding in pandemic proportions worldwide. Escalation in prevalence of diabetes appears to be more pronounced in developing countries, particularly in India.¹ Likewise, the prevalence of hypertension has increased over the past decade, reaching an alarming level of 25% among the general population in the United States and an even higher percentage in Europe.² It is an important worldwide public-health challenge because of its high frequency and concomitant risks of cardiovascular and kidney disease.

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Diabetes mellitus and hypertension frequently occur together and have synergistic detrimental effects on the cardiovascular system.³

Microalbuminuria is a well-known predictor of poor renal outcomes in patients with type 2 diabetes and in essential hypertension. It is currently considered as a strong predictor of premature cardiovascular death in these populations. There are emerging data that reduction of microalbuminuria leads to reduced risk of adverse renal and cardiovascular events. Microalbuminuria can be defined as a random urine albumin-to-Cr ratio (ACR) of 30 to 300 mg/g.

Cardiac autonomic neuropathy (CAN) is a serious and common complication of diabetes and hypertension. It is associated with a variety of adverse outcomes including cardiovascular death. Prolongation of the corrected QT interval (QTc) has been demonstrated to be a specific indicator of CAN in most studies. Many studies have been done on the association of QT interval abnormalities and microalbuminuria in type 1 diabetic patients and there are only a few reports in type 2 diabetics and hypertensive patients separately. This study is amongst the first few to study these parameters together in patients suffering from both type 2 diabetes and hypertension.

This study was directed to correlate cardiac autonomic neuropathy as predicted by prolonged QTc interval with microalbuminuria in patients suffering from type 2 diabetes, hypertension separately and together, and their relation to the severity and duration of both.

Aims & Objectives

1. To find out the association between microalbuminuria & prolonged QTc interval in patients of
 - Type-2 Diabetes Mellitus
 - Hypertension
 - Type-2 Diabetes Mellitus & Hypertension both.
2. To correlate it with the duration of disease.

II. Material And Methods

The present study was conducted in Mahatma Gandhi Medical College and Hospital, Jaipur.

Study Design

The present study was a cross sectional study on the patients of Diabetes Mellitus Type 2, Hypertension and a combined group i.e. Diabetes Mellitus Type 2 with Hypertension meeting inclusion and exclusion criteria as mentioned below. The study was carried out for period of one and a half year from Dec. 2013 to May. 2015.

Source of Data

The patients of Type 2 Diabetes Mellitus, Hypertension attending Endocrinology, Cardiology and Medicine OPD and IPD, at Mahatma Gandhi Medical College and Hospital, Jaipur were enrolled in the present study.

Sample Size

Total of 100 patients were included in the study.

Selection Criteria

Inclusion criteria:

- Patients with type 2 diabetes mellitus.
- Patients with hypertension.
- Patients with both type 2 diabetes mellitus & hypertension

Exclusion Criteria:

- History of MI / Angina
- Clinical evidence of heart failure
- Left bundle branch block
- Atrial fibrillation
- Febrile illness
- Urinary tract infection
- H/o drug intake like ACE/ARB's
- Acute poor metabolic control
- Smoking
- High serum calcium levels

The selected patients were studied in detail, history was taken and physical examination was done according to preformed semi-structural proforma.

Investigations done:-

- CBC
- Fasting blood sugar, Post prandial blood sugar
- Blood urea, Serum creatinine
- Urine routine and microscopy
- Test to detect microalbuminuria (UACR).
- ECG (to calculate QTc interval. Average of 3 QT and RR intervals from the leads where QT interval is easily identified to calculate this by BAZZET's formula – QT / \sqrt{RR} ms).
- HbA1c
- Thyroid Profile
- Fundoscopy – By Direct ophthalmoscopy.
- 2D-Echo
- Special investigations if required.

Statistical analysis:

The data were analyzed using SPSS 20. Appropriate univariate and bivariate Statistical analysis were carried out using the Student's t- test for the continuous variable (Age), Analysis of Variance (ANOVA) was applied for the comparison of three means and the individual comparisons were done using Bonferroni post hoc tests, and two-tailed Fisher exact test or chi-square (χ^2) test for categorical variables. To measure the linear dependence between two random variables Pearson's correlation coefficient was used. All means are expressed as mean \pm standard deviation and proportion are presented in percentages (%). The critical levels of significance of the results were considered at 0.05 levels i.e. $p < 0.05$ was considered significant.

Estimation of microalbuminuria:

NycoCardTM U-Albumin is a rapid in vitro test for measurement of low albumin concentrations in human urine.

TEST PRINCIPLE

NycoCardTM U-Albumin is a solid phase sandwich-format, immunometric assay. The test device contains a membrane coated with immobilized albumin specific monoclonal antibodies. When the diluted sample is applied to the test device, the sample flows through the membrane, and immobilized antibodies on the membrane capture the albumin molecules. Albumin trapped on the membrane will bind the gold-antibody conjugate then added, in a sandwich-type reaction. Unbound conjugate is removed from the membrane by the washing solution. The paper layer underneath the membrane absorbs excess liquid. Due to the bound gold particles the membrane appears purple with colour intensity measured quantitatively by using the colour densitometer NycoCardTMREADER II.

TEST CHARACTERISTICS

Analytical Specificity

Monoclonal antibodies specific to human albumin are used in the test. No other human urine components have been found to cross-react with albumin in the NycoCardTMU-Albumin test system.

Standardization

NycoCardTMU-Albumin is calibrated with internal urine standards. These standards are assayed against ERM[®] -DA470 reference preparation.

OBSERVATIONS AND RESULTS

- Out of 100 cases, 30% patients were Hypertensive, 40% had Diabetes mellitus type 2 and 30% had Diabetes mellitus type 2 with Hypertension (combined group).(FIGURE 1)
- Most of the patients belong to the age group of 50-69 years i.e. 6th and 7th decade of life.(TABLE 1)
- In the 100 cases studied, 59% were males and 41% were females. This study shows male preponderance in all 3 groups.(TABLE 2)
- Out of 100 cases,QTc prolongation was seen in 51% cases(N =51). QTc prolongation was seen in 14 of the 30 (46.67%) hypertensive patients, 15 of the 40(37.5%) diabetic patients, and 22 of the 30 (73.3%) inthe combined group (DM with HTN), which was highly significant statistically (p value = 0.001).(FIGURE 2)
- Out of 100 cases,microalbuminuriawas seen in 74%(N=74) cases. Of these cases 22 out of 30 (73.33%) belonged to the Hypertensive group,24 (60%) out of 40 cases belonged to DM type 2 group, which was statistically significant (p value < 0.001). 28 (93.3%) out of 30 cases belonged to combined group i.e. Diabetes with Hypertension, which was highly significant statistically (p value < 0.001).(FIGURE 3)
- Out of 30 cases with HTN, 14 cases hadQTc prolongation and 22 cases hadmicroalbuminuria. Out of 22 cases of microalbuminuria, 13 cases had QTc Prolongation (59.1%) and 9 cases did not show QTc

Prolongation. Out of 8 cases with normoalbuminuria, 1 case showed QTc Prolongation and 7 cases did not. P value < 0.05 is statistically significant.(TABLE 3)

- Out of 40 cases with DM type 2, 15 cases hadQTc prolongation and 24 cases had microalbuminuria. Out of 24 cases of microalbuminuria, 12 cases had QTc Prolongation (50%) and 12 cases did not show QTc Prolongation. Out of 16 cases with normoalbuminuria, 3 cases (18.8%) showed QTc Prolongation and 13 cases did not. P value < 0.05 is statistically significant. (TABLE 4)
- Out of 30 cases with DM type 2 and Hypertension, 22 cases hadQTc prolongation and 28 cases hadmicroalbuminuria. Out of 28 cases of microalbuminuria, 22 cases had QTc Prolongation (78.6%) and 6 cases did not show QTc Prolongation. Out of 2 cases with normoalbuminuria, both cases did not show QTc prolongation. P value < 0.05 is statistically significant. (TABLE 5)
- In Hypertension group 18 cases were observed with <5 year duration of disease ,out of which 5 cases (27.8%) had QTc prolongation. In 5-10 year duration 12 cases were observed, out of which 9 cases (75.0%) had QTc prolongation. This was statistically significant, showing significant association of QTc prolongation with increased duration of disease (p value <0.01).(TABLE 6)
- In DM group 19 cases were observed with <5 year duration of disease,out of which none of the cases (0%) had QTc prolongation. In 5-10 year duration 18 cases were observed, out of which 13 cases (72.2%) had QTc prolongation. In >10 year duration, 3 cases were observed, out of which 2 cases (66.7%) had QTc prolongation .This was statistically significant, showing increased incidence of QTc prolongation with increased duration of disease (p value - <0.001).(TABLE 7)
- In patients with both Diabetes and Hypertension 16 cases were observed with <5 year disease duration, out of which 14 cases (87.5%) had QTc prolongation. In 5-10 year duration, 8 cases were observed, out of which 6 (75%) had QTc prolongation. In >10 year duration, 6 cases were observed, out of which 2 cases (33.33%) had QTc prolongation. This was statistically significant (p value <0.05).(TABLE 8)
- In our study, in HTN group, out of 18 cases with <5 year disease duration, 11 (61.1%) cases were observed with microalbuminuria. In 5-10 year duration out of 12 cases, 11 (91.7%) had microalbuminuria which was statistically not significant (p>0.05). However, 95% CI for the risk in exposed was 38.89%. The lower limit was 20.23 and the upper limit was 61.46, which indicates that there is higher probability of presence of microalbuminuria with increase in duration of disease.(FIGURE 4)
- In DM group 19 cases were observed with <5 year diseaseduration ,out of which 5 cases (26.3%) had microalbuminuria. In 5-10 year duration 18 cases were observed, out of which 17 cases (94.4%) had microalbuminuria. In >10 year duration, 3 cases were observed, out of which 2 cases (66.7%) had microalbuminuria. This was statistically significant, showing increased incidence of microalbuminuria with increased duration of disease. (p value <0.001)(FIGURE 5)
- In the group with HTN+DM, 16 cases were observed with <5 year diseaseduration, out of which 15 cases (93.8%) had microalbuminuria. In 5-10 year duration, 8 cases were observed, out of which 7 (87.5%) had microalbuminuria. In >10 year duration, all the 6 cases had microalbuminuria. (FIGURE 6)
- Although this was not significant (p > 0.05), however 95% CI for the risk in exposed was 6.25% and the lower limit was 0.00 and the upper limit was 30.31, which indicates that there is high probability of microalbuminuria with increase in duration of disease.

III. Discussion

- In our study out of 40 cases of DM, 23 patients (57.5%) were males and 17 patients (42.5%) were females. Similarly, out of 30 patients with hypertension and out of 30 patients having both DM+HTN together,18 (60%) were males and 12 (40%) were females. Thus a male preponderance was seen in our study. This is in concordance with the study done by **Marques da Silva P. et al (2015)⁴** where 51.1% of diabetic patients were males, 51% of patients were males in combined group i.e. DM+HTN but in hypertensive group, female preponderance was seen. While in contrast to this study, another study which was done by **BusariOA. et al (2011)⁵** reported a male preponderance (54.2%) in the hypertensive group.
- In our study, the mean age of the patients with hypertension was 55.93±14.21 years. The mean age of the patients with diabetes mellitus was 52.22±11.12 years. The mean age of the patients having both diabetes mellitus and hypertension together was 62.03±7.937 years, which was significant as compared to both groups separately. This implies that as the age advances and the patient enters into the 6th decade of life, the chances of combined hypertension and diabetes mellitus are higher.

The age distribution of our study population correlates well with other studies.

Groups	Mean Age (Years) in Different Studies		
	Marques Da Silva P.et al (2015) ⁴	Takahashi N.et al ³ (2001)	Present Study
HTN	63.4±12.9	-	55.93±14.21

DM	59.1±12.2	56±6	52.22±11.12
DM + HTN	65±11.1	56±8	62.03±7.94

- In our study, out of 40 cases of DM 15 cases (37.5%) had QTc prolongation (CAN). In various studies prevalence of QTc prolongation in diabetic patients was similar to our study shown below.

Study	Year of study	Prevalence of CAN in Diabetes Mellitus Type 2
Ziegler. et al ⁶	1992	38.8%
CP Mathur. et al ⁷ (Done in Rajasthan)	2006	38%
Timar R. et al ⁸	2013	34.6%
Odusan O. et al ⁹	2008	34.2%
Present Study		37.5%

- Ziegler. et al⁶ in (1992) and CP Mathur. et al⁷ in (2006) found QTc prolongation (CAN) in 38.8% and 38% respectively. Similarly Timar R. et al⁸ in (2013) and Odusan O. et al⁹ in (2008) found QTc prolongation (CAN) in 34.6% and 34.2% respectively.
- In the present study, out of 30 cases of hypertension, 14 cases (46.7%) had prolonged QTc (CAN). **Ioana Mozos. et al (2011)**¹⁰ found 69% and **Adeseye A. et al (2012)**¹¹ found 52.14% of patients with HTN having CAN.

The difference in the prevalence of CAN in HTN can be attributed to the difference in characteristics of study population like age, duration and severity of disease and methodology adopted to assess CAN.

- In our study out of 30 patients in combined group i.e. HTN+DM, 22 (73.3%) had CAN which was statistically highly significant (p<0.001). This implies that HTN and DM together causes more damage to the cardiac autonomic nervous system and this correlates well with the study done by **Takahashi N. et al (2001)**³ who found that HTN and DM together have got synergistic detrimental effect on the cardiac autonomic nervous system.
- In our study, out of 40 patients with Type 2 DM 24 (60%) patients had microalbuminuria which was statistically significant. In the studies done by **Abdulrahman A. (2007)**¹², **Varghese A. et al (2001)**¹³ and **A.Y.T.WU. et al (2005)**¹⁴ found the prevalence of microalbuminuria in diabetic patients to be 45.6%, 36.3%, 39.8% respectively.

- In our study, out of 30 patients with HTN, 22 (73.33%) patients had micro albuminuria and in 30 patients of combined group i.e. DM with HTN, 28 (93.3%) had microalbuminuria (p<0.001). **Poudel B. et al (2012)**¹⁵ found 51.88% of hypertensive patients had microalbuminuria while **De Alvaro F. et al (2005)**¹⁶ found 62.5% of subjects had microalbuminuria.

Marques da Silva P. et al (2015)⁴ in their study reported 43% of hypertensive patients with microalbuminuria and 58% patients in combined group i.e. DM with HTN had microalbuminuria, which is statistically significant.

Bohm M. et al (2007)¹⁷ reported an overall prevalence of micro albuminuria in combined group to be 58.4%, ranging between 53%-71% in different countries.

This variation in the prevalence of microalbuminuria can be attributed to several factors such as difference in populations regarding age, sex, duration and severity of disease, the definition of microalbuminuria, the methods of measurement of microalbuminuria and urine collection etc.

- In our study, positive association was found between microalbuminuria and prolonged QTc interval in all the three study groups. Out of 24 patients of type 2 DM with micro albuminuria, 12(50%) patients had prolonged QTc interval which was statistically significant. Out of 22 patients of HTN with microalbuminuria, 13 (59.1%) patients had prolonged QTc interval, which was statistically significant. Out of 28 patients of microalbuminuria in combined group i.e. DM+HTN, 22 (78.6%) patients had prolonged QTc interval, which was statistically significant.

In the study done by **Rutter MK. et al (2002)**¹⁸, 67% of patients with had prolonged QTc interval.

In the study done by **Mehta S. et al (2002)**¹⁹, 47.82% of patients with CAN had microalbuminuria, which was statistically significant.

In the study done by **Basu AK. et al (2010)**²⁰, 14 (77.77%) out of 18 patients of type 2 DM with microalbuminuria had prolonged QT interval, which was significant p<0.05.

In the study done by **Olusegun. et al (2010)**²¹, significant positive correlation was found between microalbuminuria and prolonged QT interval in hypertensive patients with 16.1% of patients with microalbuminuria had prolonged QT interval (p=0.001).

- In type 2 DM group, 19 cases were observed with <5 year disease duration and none of the cases had prolonged QTc interval. In 5-10 year duration 18 cases were observed, out of which 13 (72.2%) had prolonged QTc interval. In >10 year duration, 3 cases were observed, out of which 2 (66.7%) had

prolonged QTc interval ($p < 0.001$), showing positive correlation between the increased chances of QTc interval prolongation with increased duration of DM.

In a study conducted by **Pappachan JM. et al (2008)**²² disease duration over 10 years resulted in QTc prolongation in a significant numbers of cases with type 1 ($p < 0.001$) and type 2 ($p = 0.006$) diabetes. In the study by **Mohan V. et al (1996)**²³, there was an increase in prevalence of autonomic dysfunction with duration of diabetes. In the 0-5 years duration group, 28.2% of NIDDM had evidence of disordered autonomic function and these figures increased to 56.2% , after 16-20 years duration of diabetes.

Khoharo HK. et al (2012)²⁴ in their study found that cardiac autonomic neuropathy manifestations were prominent in diabetics of > 5 years when compared with patients for <5 years ($p < 0.003$). Thus, our result correlates well with these studies.

- In DM group 19 cases were observed with <5 year duration. Out of which 5 cases (26.3%) had microalbuminuria. In 5-10 year duration 18 cases were observed, out of which 17 cases (94.4%) had microalbuminuria. In >10 year duration 3 cases were observed, out of which 2 cases (66.7%) had microalbuminuria. This was statistically significant, showing increased incidence of microalbuminuria with increase in duration of disease.

Similarly, **Schmitz A. et al (1988)**²⁵ in their study found significant positive correlation between duration of type 2 DM and microalbuminuria. ($r = 0.14; P < 0.01$).

Patel LK. et al (1999)²⁶ also found increased prevalence of microalbuminuria with increase in duration of DM.

IV. Conclusion

In our study we found that there was a high prevalence of Cardiac Autonomic Neuropathy (CAN) (as predicted by prolonged QTc interval in ECG) and Diabetic Nephropathy (as predicted by microalbuminuria) in patients with Type 2 DM and HTN. The prevalence is significantly high in patients with both DM+HTN. Also, the prevalence increased with increase in duration and severity of the disease. The complication occurs at lesser duration, with DM and HTN combined together.

This signifies that metabolic disturbances in DM and HTN acts independently in causing these microvascular complications and when combined together have got synergistic effect. This implies that early diagnosis, timely and effective treatment can help in preventing these complications to some extent.

We also found positive association between microalbuminuria and prolonged QTc interval in all the three study groups. Thus, microalbuminuria signifies QTc prolongation in patients with DM and HTN. It indicates excess cardiovascular morbidity and mortality in these patients. We recommend screening for microalbuminuria in newly diagnosed hypertensive and diabetic patients and to look for the presence of CAN (prolonged QTc interval) in positive cases. This will help in taking timely therapeutic measures to prevent any major adverse cardiovascular event.

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Table 1: Age Distribution

Age (Years)	Group			Total
	HTN	DM	DM+HTN	
30-39	4	6	0	10
40-49	5	10	2	17
50-59	12	10	5	27
60-69	4	12	21	37
≥70	5	2	2	9
Total	30	40	30	100
Mean Age	55.93	52.22	62.03	
±SD	±14.21	±11.12	±7.93	

Table 2: Sex Distribution

	Group			Total
	HTN	DM	DM+HTN	
Male	18	23	18	59
Female	12	17	12	41
Total	30	40	30	100

Table 3:

Association of QTc Prolongation (CAN) with Microalbuminuria in Hypertension Cases.

Group	Microalbuminuria (30-300 µg/mg Cr.)	QTc Prolongation (>440 m sec)		Total
		Present	Absent	
HTN	Normoalbuminuria (<30)	1 (12.5%)	7 (87.5%)	8 (100%)
	Microalbuminuria (30-300)	13 (59.1%)	9 (40.9%)	22 (100%)
	Total	14 (46.7%)	16 (53.3%)	30 (100%)

Chi-square: 5.12, p- value < 0.05, fishers exact p value (2 tailed) =0.03945.

Table 4:

Association of QTC Prolongation (CAN) with Microalbuminuria in Diabetes Mellitus Cases

Group	Microalbuminuria (30-300 µg/mg Cr.)	QTc Prolongation (>440 m sec)		Total
		Present	Absent	
DM	Normoalbuminuria (<30)	3 (18.8%)	13 (81.2%)	16 (100%)
	Microalbuminuria (30-300)	12 (50%)	12 (50%)	24 (100%)

	Total	15 (37.5%)	25 (62.5%)	40 (100%)
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Chi-square: 4.00, p- value < 0.05

Table 5:
Association of QTc Prolongation with Microalbuminuria in Diabetes with Hypertension Cases

Group	Microalbuminuria (30-300 µg/mg Cr.)	QTc Prolongation (>440 m sec)		Total
		Present	Absent	
DM + HTN	Normoalbuminuria (<30)	0 (0%)	2 (100%)	2 (100%)
	Microalbuminuria (30-300)	22 (78.6%)	6 (21.4%)	28 (100%)
	Total	22 (73.3%)	8 (26.7%)	30 (100%)

Chi-square: 5.89, p- value < 0.05

Table 6:
Correlation between Duration of Hypertension and QTc Prolongation

Duration (Years)	HTN		
	QTc Prolongation		
	Present	Absent	Total
<5	5 (27.8%)	13 (72.2%)	18 (100.0%)
5-10	9 (75.0%)	3 (25.0%)	12 (100.0%)
Total	14 (46.7%)	16 (53.3%)	30.0 (100.0%)
Mean Duration ± S.D	5.65 ±2.451	3.34 ±3.327	

Chi square: 6.451; p < 0.01 at 1df

Table 7:
Correlation between Duration of Type 2 DM and QTc Prolongation

Duration (years)	DM		
	QTc Prolongation		
	Present	Absent	Total
<5	0 (0.0%)	19 (100.0%)	19 (100.0%)
5-10	13 (72.2%)	5 (27.8%)	18 (100.0%)
>10	2 (66.7%)	1 (33.3%)	3 (100.0%)
Total	15 (37.5%)	25 (62.5%)	40 (100.0%)

Chi square = 21.71; p<0.001 at 2df

Table 8:
Correlation between Duration of Type 2 DM and Hypertension With QTc Prolongation

Duration (Years)	DM+HTN		
	QTc Prolongation		
	Present	Absent	Total
<5	14 (87.5%)	2 (12.5%)	16 (100.0%)
5-10	6 (75.0%)	2 (25.0%)	8 (100.0%)
>10	2 (33.3%)	4 (67.7%)	6 (100.0%)
Total	22 (73.3%)	8 (26.7%)	30 (100.0%)

Chi square: 6.563; p < 0.05 at 2df

FIGURE-1: Distribution of Cases.

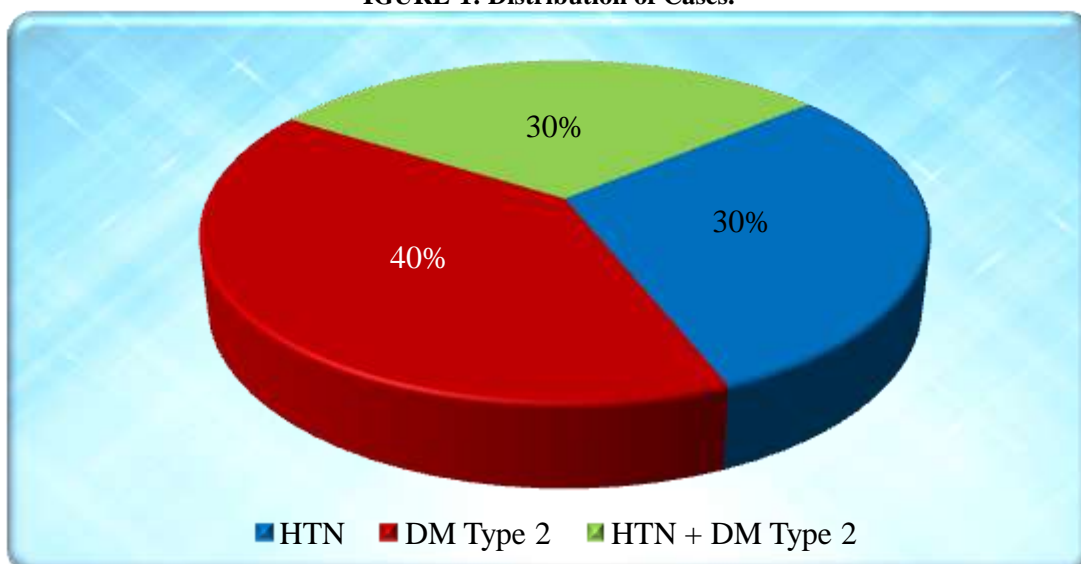


FIGURE 2: QTc Prolongation Distribution

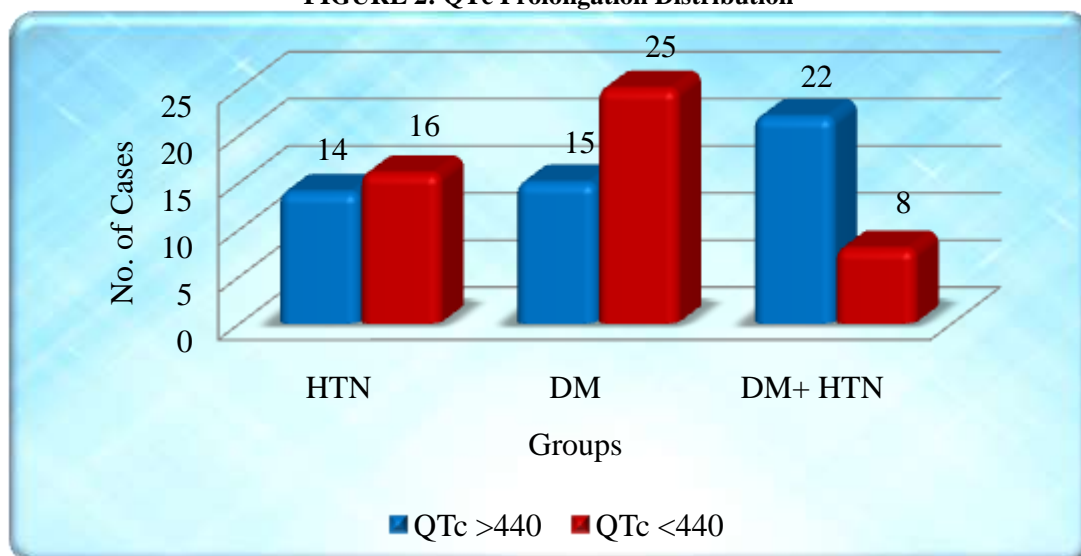


FIGURE 3: Microalbuminuria Distribution

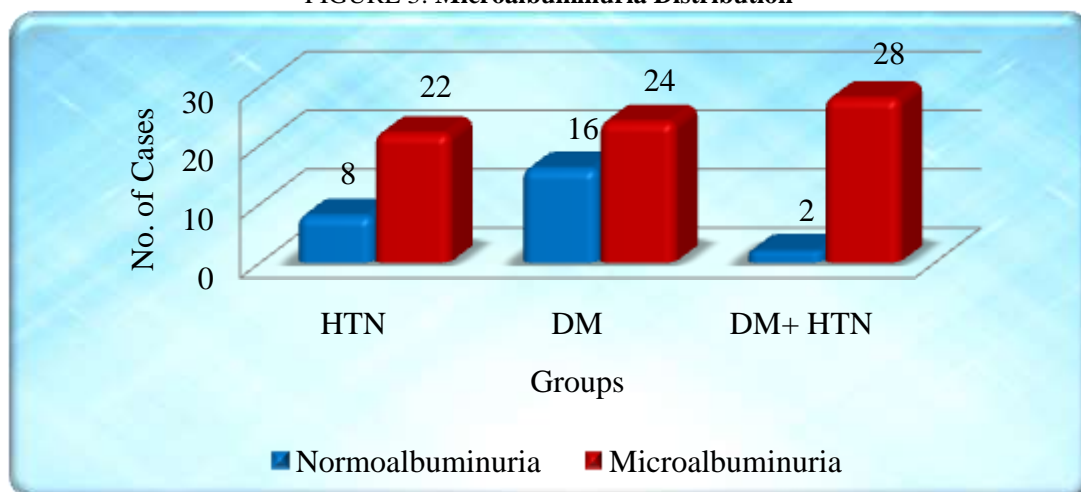


FIGURE 4: Correlation between Duration of Hypertension and Microalbuminuria

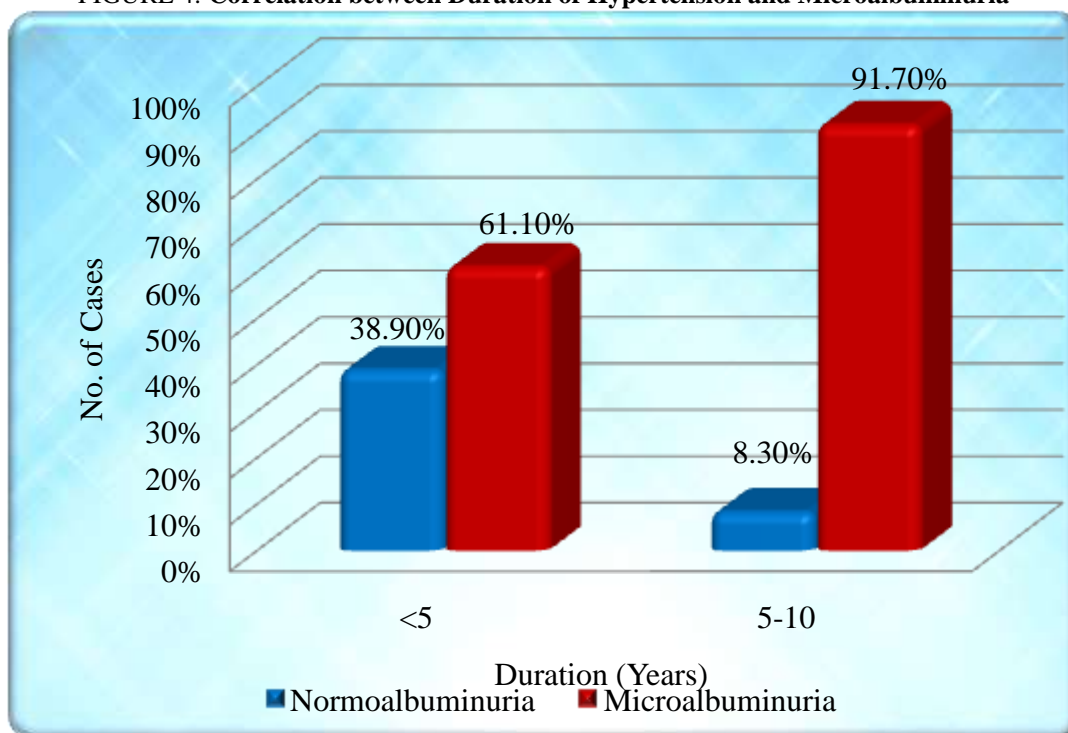


FIGURE 5: Correlation between Duration of Type- 2 Diabetes with Microalbuminuria

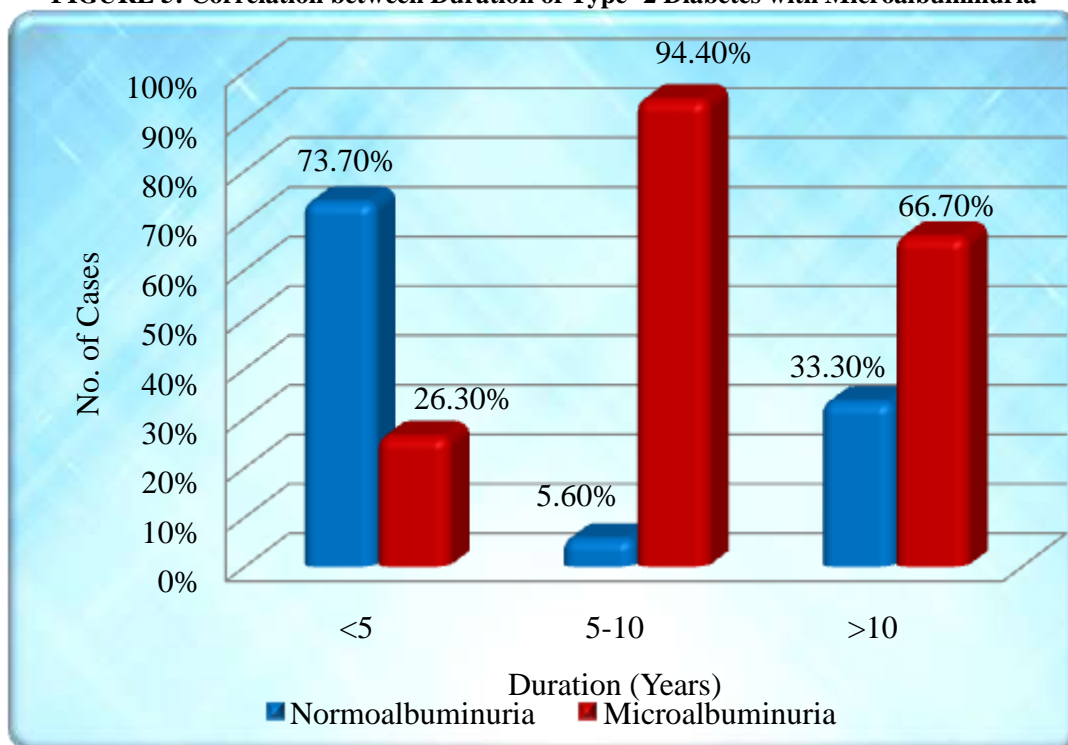
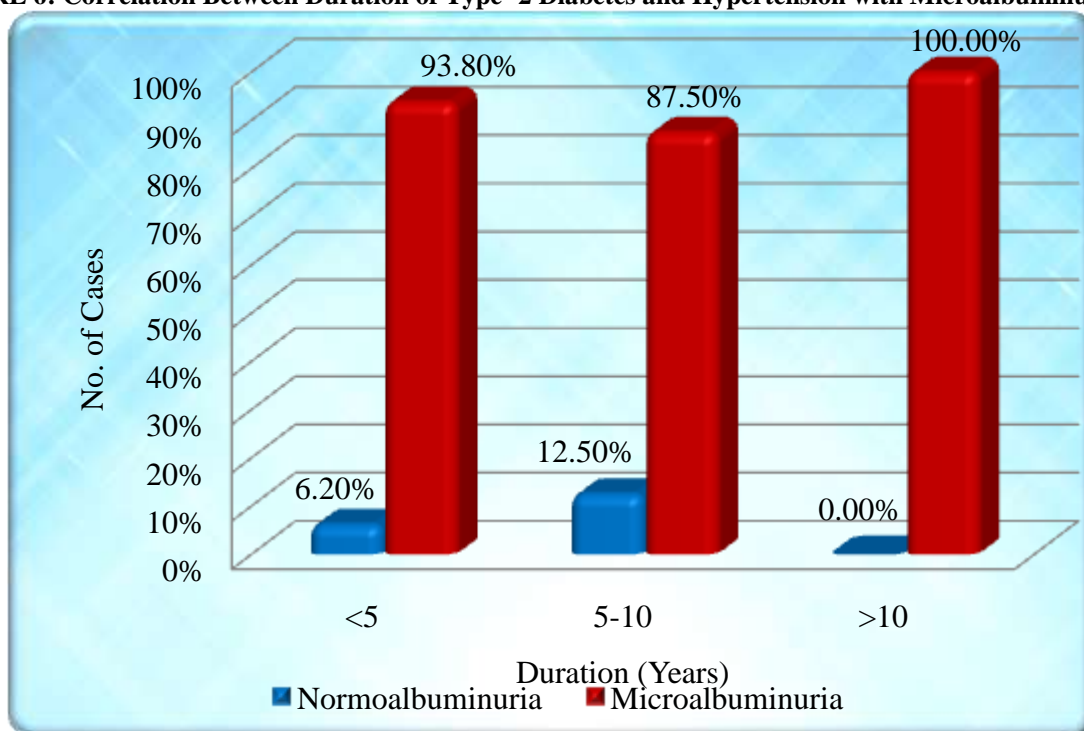


FIGURE 6: Correlation Between Duration of Type- 2 Diabetes and Hypertension with Microalbuminuria



Dr Surender Mittal "Predictive Value And Association Between Microalbuminuria And Prolonged Qtc Interval In Hypertensive And Type 2 Diabetes Mellitus Patients "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 5, 2018, pp 47-57